CLAIMS

I/We claim:

[c1] 1. A product for interfacing with a plurality of file-systems and block devices, said product creating and handling multiple snapshot instances in a computer storage system, the product implementing the process of:

identifying one or more blocks being used;

creating a snapshot record for each of said blocks on a base volume at a first time;

performing snapshot management functions to said blocks on said base volume;

handling snapshot records of said blocks on said base volume at a second time; and

allowing writing of data on said blocks to free space on said base volume.

[c2] 2. The product of Claim 1, wherein creating a snapshot record at the first time further comprises:

suspending all of the write operations issued from file systems;

identifying the blocks called by file systems;

creating a snapshot record for each of the identified blocks; and

resuming the write operations issued from the file systems to the said blocks on said base volume.

[c3] 3. The product of Claim 2, wherein creating a snapshot record at a block further comprises:

counting the number of write operations being taken to the said block; and

creating a binding of a copy-on-write block associated with the said block as well as the associated snapshot instances.

[c4] 4. The product of Claim 1, wherein creating a new snapshot instance comprises:

allocating an unused bit in a counting bitmap to identify the created snapshot instance; and

updating all of the allocated bits in the counting bitmap.

[c5] 5. The product of Claim 1, wherein handling a snapshot record comprises:

suspending the write operation to blocks on base volume;

updating a counting bitmap;

checking the snapshot record to determine whether a copy-on-write operation is needed;

allocating free space on the base volume; and

performing the copy-on-write operation to the allocated block in free space when a copy-on-write is needed; otherwise, resuming the write operation to blocks on base volume.

[c6] 6. The product of Claim 5, wherein allocating free space on the base volume comprises:

selecting an unused block on the base volume;

identifying the selected block in the snapshot record;

updating block allocation bitmap and snapshot block allocation bitmap of file system.

[c7] 7. The product of Claim 6, wherein allocating free space for storing snapshot records comprises:

dynamic allocating one or more free blocks when size of snapshot record grows and freeing allocating blocks when size of snapshot record shrinks.

[c8] 8. The product of Claim 6, wherein freeing blocks on the base volume further comprises:

marking the freed blocks as unused ones in both the block allocation bitmap and the snapshot block allocation bitmap of file system.

[c9] 9. The product of Claim 1, wherein handling a snapshot instance created on the base volume during a delete operation comprises:

suspending all write operations issued from file system to the base volume;

identifying a counting bit corresponding to the said snapshot instance;

removing unused record of write operation to its associated block; finding all copy-on-write blocks associated with said snapshot instance;

freeing said copy-on-write blocks when they have no other snapshot instance to associate with; otherwise, resuming all pending write operations issued from file system to base volume.

[c10] 10. The product of Claim 1, wherein handling a snapshot instance being created on the base volume during a storing operation further comprises:

restraining all write operations issued from file system to said base volume;

identifying all copy-on-write blocks associated with said snapshot instance;

exchanging data on copy-on-write blocks with data on the blocks associated with the snapshot instance;

updating the state of snapshot record;

updating the block allocation bitmap and snapshot block allocation bitmap of file system;

restarting the write operations of the file system to the base volume.

[c11] 11. The product of Claim 10, wherein updating the block allocation bitmap and snapshot block allocation bitmap of a file system comprises:

freeing all blocks being marked as used in the snapshot block allocation bitmap;

marking blocks which are currently used by the product as used in both bitmaps.